

manufacturer. However, Durbin maintains that difficulties still exist in establishing a clear flow of information from manufacturers and EPP program staff to the often bewildered purchasing officials at the end of the line. Goidel is hopeful that the soon-to-be-released guidance, as well as the environmental considerations that are now incorporated in the Federal Acquisition Regulations (as she describes it, a "bible to purchasing officials"), will help in this respect.

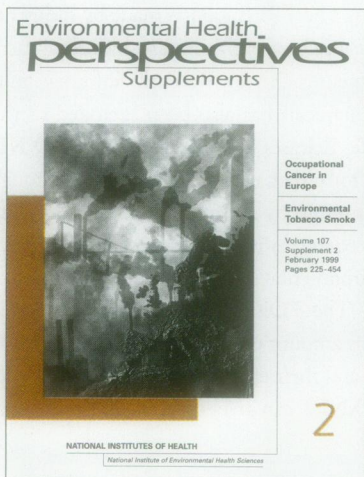
Meanwhile, the concept of EPP is getting some strong congressional support. A bipartisan group of senators led by Tom Harkin (D-Iowa), recently requested a \$4 million budget increase for the program from the Office of Management and Budget. Harkin, who advocates increased use by the federal government of agricultural by-products as substitutes for synthetic materials such as inks, lubricants, and adhesives, has also called for the creation of an interagency environmentally preferable products coordinating council to coordinate product identification and information dissemination.

According to Goidel, state governments are instituting programs similar to the EPP program, and international interest in the U.S. experience is growing. "Many companies are excited about the trend [toward environmentally preferable products]," she says. "Other companies could lose market share unless they change their products as well. We're encouraging environmental concerns as well as price and performance. Companies that optimize all three will be the winners."

EHPS Publishes Evidence on Environmental Tobacco Smoke

The evidence continues to mount that environmental tobacco smoke (ETS), also known as secondhand smoke, affects more than just smokers. The April 1999 issue of *Environmental Health Perspectives Supplements* brings much of this evidence together as it delves into the various health, risk assessment, and quantification aspects of ETS exposure.

The issue contains the proceedings of a workshop held in Baltimore, Maryland, in September 1997 that examined the occurrence of ETS in the workplace. Contributing authors had conducted reviews in their areas of expertise with the goal of developing a risk assessment for worker exposure to ETS.



Roger A. Jenkins and Richard W. Counts of Tennessee's Oak Ridge National Laboratory reviewed the use of personal exposure assessment in two recent studies on occupational exposure to ETS. Personal exposure assessment uses an individual sampling device to gather contaminant samples from each subject's breathing zone.

The first study examined subjects both at work and away from work, fitting them with strap-on sampling devices. Workers in facilities where smoking is permitted were found to be exposed to 10–20 times more ETS than those who worked in places where smoking is banned. Workers in facilities with smoking and nonsmoking sections were exposed to 2–8 times less ETS than workers in facilities where smoking is permitted throughout. However, all the exposures were generally found to be much lower than those estimated in earlier studies.

The second study examined waitstaff and bartender exposures to ETS on the job, using sampling devices similar to those in the first study. The median level of ETS exposure in a single-room bar was found to exceed that in a multiroom establishment by a factor of 10. Still, Jenkins and Counts concluded that, while some occupational groups are exposed to more ETS than other groups, even the most highly exposed subgroup studied (bartenders working in single-room bars) is not exposed to levels as high as those estimated in a 1994 ETS risk assessment published by the Occupational Safety and Health Administration.

Other scientists feel that biomarkers provide the best means for quantifying exposures to ETS. Neal L. Benowitz, a professor in the division of clinical pharmacology and experimental therapeutics at the University of California at San Francisco, wrote of how the nicotine metabolite cotinine works as a sensitive, specific biomarker for human exposure to ETS. Cotinine is one of the most frequently used biomarkers for quantifying ETS exposure because its presence in the body is almost exclusively due to exposure to tobacco. Other biomarkers have been proposed for use in measuring ETS exposure, but some, such as carbon monoxide, are not specific to tobacco and may occur in response to a variety of other exposures or even through the body's own metabolic processes. Still other proposed biomarkers, such as solanesol, are

difficult to accurately measure.

Still, cotinine's validity has been challenged. Critics have argued that people are exposed to nicotine not just through smoking but also through foods such as black tea and tomatoes. Benowitz countered that levels of dietary nicotine reported in earlier studies are unrealistically high. To take in the amount of dietary nicotine attributed in one 1991 study to drinking black tea, for instance, the subject would have to have drunk about four quarts of the beverage per day.

Another criticism is that cotinine levels may be influenced by exposures occurring in the absence of ETS, such as walking into a room where someone previously smoked. According to Benowitz, such situations are a trivial source of nicotine exposure; using a calculation method he described in his paper, the amount of nicotine taken in from such sources would result in a urine cotinine concentration of as little as 0.1 ng/mL, over 75% lower than that expected of a nonsmoker exposed to ETS in a smoky bar.

In his *EHPS* paper, Neil E. Klepeis of the department of environmental health sciences at the University of California at Berkeley took a look at smoke itself. He reviewed three recent studies on how ETS pollutants actually move and mix in the air, and reanalyzed data from several other published studies of ETS. Klepeis said the typical approach of assuming perfect mixing of pollutants and of equating a person's ETS exposure with a measurement at a single point in a room may not always be an accurate representation of actual ETS exposure.

Klepeis demonstrated how running means can be used to determine the averaging, or mixing, time that is required before ETS exposure measurements taken at any one point in a room will be within 10% of the spatial room mean. Based on data collected in a residence, a tavern, and smoking lounges, Klepeis concluded that averaging times ranging from 12 to 80 minutes (depending on the environment) appear to be sufficient.

Averaging times need to be considerably longer for environments where many smokers are present, such as in a bar or party, than for environments where one smoker lights up a single cigarette. Starting with the case for a single, brief ETS source, Klepeis presented a method for estimating appropriate averaging times in multiple-smoker environments by treating overlapping smokers as a continuous source of ETS.

The April issue is rounded out with papers that examine alternate methods for assessing exposure to ETS, investigate mathematical models for predicting indoor air quality from smoking activity, and explore issues in ETS exposures in the workplace.